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THE PROSPECTS OF THE HELICOPTER.

By Edward P. Warner.

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By Edward P. Warner.

The helicopter, or direct lift airplane obtaining its support from the vertical thrust of propellers turning in a horizontal plane instead of from the air reaction on wings, has always been a device of great interest to scientists from other fields than that of aeronautics. It is curious to observe that whereas the airplane has been developed almost entirely by young men not previously noted as inventors, engineers, or scientists (Dr. Langley being the notable exception to this rule) the fortunes of the helicopter have been more in the hands of those with reputations previously acquired in other fields. Mr. Edison has long been a believer in the future of the helicopter as the best means of air transportation, and some of the most important contributions to helicopter design and invention in America have been made by the late Peter Cooper Hewitt, the inventor of the mercury arc light, and by Dr. Berliner, originally responsible for the disc talking machine.

The helicopter undoubtedly has a great deal to commend it. Its most important advantage, of course, is its ability to rise vertically from a standing start, eliminating the necessity for the long preliminary run characteristic of the airplane. It offers also the possibility of hovering motionless over a given spot, a feature of tremendous usefulness for military purposes. In fact, it has frequently been suggested that the helicopter be taken from the Christian Science Monitor.

used to replace the observation balloon, either ascending and hovering in free flight above the lines or actually being restrained in its vertical motions by a cable like that of the balloon which it replaces. The helicopter for such service would, of course, have the great advantage of complete non-inflammability an advantage over the balloon which disappears, however, as soon as the non-inflammable helium is used in place of hydrogen for inflation of the lighter-than-air craft.

Its Outstanding Advantages.

The manifest advantages of the helicopter have attracted hundreds, if not thousands, of inventors to the study of the problem. In fact, there has probably been more invention in this field than in any other single branch of aeronautics. Most of the devices produced and patented have, however, been unworkable, and it is evident by an inspection of the patents that many of them have been designed without any true idea of the nature of the problem which has to be met.

There are really four distinct phases of that problem. The first and the simplest, although it is the one to which the inventor ordinarily gives most of his attention, is the securing of sufficient thrust to get off the ground. It is very easy to get enough thrust from a propeller to lift the power plant and a reasonable amount of extra load, particularly if a large propeller be used. The lifting power of a helicopter with a given engine increases steadily as the size of the propeller is increased and its

rate of rotation is decreased by gearing down from the engine. It is not at all difficult to obtain a lift of 15 pounds per horsepower, and with aircraft engines weighing less than two pounds per horsepower in some cases, 15 pounds gives an ample margin for the weight of the structure, the pilot, and gasoline and oil for a flight of considerable length. Unfortunately, the dissemination of aerodynamic information has been so limited in the past that it is not fully appreciated in all quarters that no real difficulty arises in securing the necessary lift and that the real essence of the problem is to be sought elsewhere.

Safety Devices.

A much more serious matter is the return to earth in case of an engine failure. The conventional helicopter would drop like a stone if the propeller stopped rotating, and the plan frequently proposed of releasing under those circumstances a parachute of sufficient dimensions to carry the whole machine, is certainly unworkable. It requires a parachute about 25 feet across to carry a single man, and to carry a 2000-pound helicopter with its crew and enable them to make a landing at a safely moderate speed in case of trouble, would have to be at least 100 feet in diameter. Manifestly the provision of any such bulky piece of apparatus as this would be an unsatisfactory solution. A number of different schemes have been proposed which seem likely to make safe landing possible even if the engines fail completely. The most promising suggestion to date appears to be that which involves the complete disconnection of the propellers from the engines and a change in

angles of the propeller blades, so that the propeller would spin around like a windmill, driven by the air pressure during the descent. The resistance to falling which can be obtained in this way is very much greater than that which would be secured if the propeller were held stationary. This is illustrated by the well-known fact that the resistance of an airplane while diving is much larger if the propeller is allowed to spin around, cranking the engine, than it is if the engine compression and friction are sufficient to hold the propeller stationary and prevent it from whirling.

Problem of Control.

The third division of the helicopter question is that of control and stability. The control which will keep the helicopter right side up has caused a great deal of perplexity to those whose researches have actually reached the point of building a helicopter, and various expedients have had to be adopted. In the Petroczy-Karman helicopter, for example, which made a number of successful flights in Austria during the war, the stability was insured by tethering the helicopter to the ground with three cables running to three different points. As long as all of the cables were kept taut, it was evidently impossible to tip over. On the other hand, in the Oehmichen helicopter, more recently produced in France, the stabilizing influence is obtained by the introduction of a balloon above the propellers. The buoyancy of the hydrogen-filled balloon acts to keep the helicopter right side up, although the balloon is by no means large enough to lift the whole

weight. Other helicopters have used devices less radical than these. Most of the controls consist of various arrangements of fins to be moved about in the stream of air projected by the propeller, but various other ingenious mechanical arrangements have been employed. One of the most interesting was that first used on the Damblanc helicopter, where it was possible to change the angle of any blade of either propeller independently of the rest and so to get more lift from one side of the helicopter than from the other. To prevent spinning around, continuously with any sort of helicopter, at least two propellers must be used in order that their twisting tendencies may be balanced.

Versatile Locomotion.

Finally, it is necessary to design a helicopter so that it cannot only rise and hover, but also so that it can travel horizontally in any desired direction with reasonable speed. The horizontal travel can be secured either by tilting the whole helicopter so that the propeller pulls it both forward and upward or by the use of an auxiliary propeller for horizontal drive.

It seems surprising, in view of the years of work on the subject, that it is only now that practical results seem to be within reach. That is the case however, and the designers who are finally reaching the point where the helicopter seems likely to become a workable craft are the more to be congratulated on that account. The time that has been taken to obtain success is

a measure of the difficulty of the problem. Within the past year at least three helicopters have made short flights under satisfactory control and others which appear to have great promise are in process of construction.

